Pattern recognition for the VHMS deposit based on the canonical correlation analysis

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Identification of the hydrothermal alteration and mineralized zones are some of the objectives of geoscience investigations. For this purpose, different multivariance statistical analyses are used to summarize variables that play an important rule in the mineralization, and measured in different units. Canonical correlation analysis [1, 2, 3, 4, 5] was used to identify the major and trace elements distribution in the altered rocks adjacent to the mineralized zone of the VHMS deposit.

The peraluminous rocks are closely related to VHMS deposits and alteration zones in the research area. The variation of the peraluminous factor versus the other factors (Figs 1 and 2) are used to identify those samples that are affected by the alteration. The final result of canonical correlation analysis led to a pattern recognition for the VHMS deposit and follow-up exploration.programme.

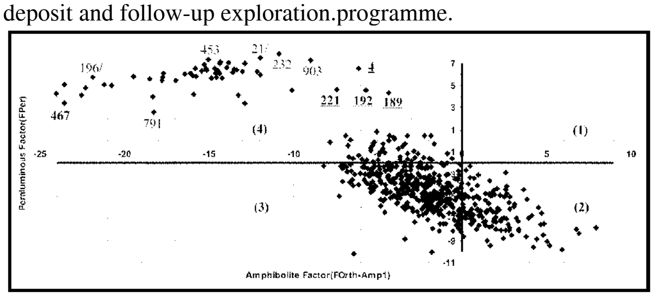

Figure 1: The peraluminous factor vs. amphibolite factor.

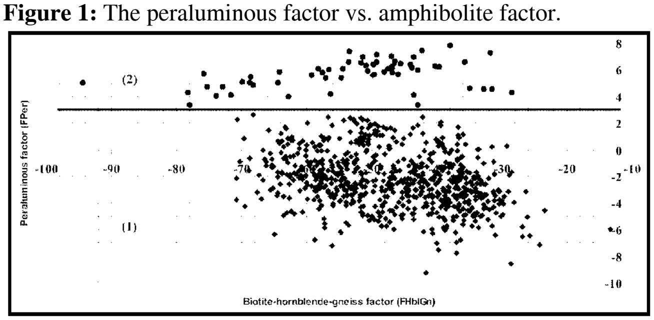

Figure 2: Biotite-hornblende-gneiss factor vs. peraluminous factor.

[1] Gardner *et al.* (2006) *Comp. Stat. & Data Anal.***50**, 107-134. [2] Ghavami-Riabi (2006) *Doctoral thesis*, 306. [3] Kshirsagar (1972) Marcel Dekker, Inc. [4] Mardiaet al. (1979) *Academic press, Inc.* [5] Stokes *et al.* (1992) *Quat. Inter*. **13-14**, 103-117.

Origins of dolomites and pyrites associated with the Hormoz Island salt dome, in the Persian Gulf, Iran

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Hormoz Island is a salt diapir in eastern Persian Gulf, belonging to the salt plugs of the Zagros foldbelt. The Hormoz complex composed of evaporites, carbonates, clastics and volcanics constituting core of the salt plugs.

Crystals of black, white and gray dolomite, pyrite, gypsum, anhydrite, apatite and iron oxides are associated with the Hormoz and other salt plugs. These dolomites are interpreted as hydrocarbon-induced products formed by hydrocarbon oxidation.

The $\delta^{13}C$ of black dolomite range from –0.8 to –1.94‰ VPDB, indicating little if any of the carbon is derived from HC oxidation with sea water providing carbon for dolomite precipitation. The $\delta^{18}O$ values of these dolomites range from -12.61 to -15.20‰ VPDB.

$\delta^{13}C$ of white and grey dolomites range from –18.66 to –29.31‰ VPDB with the depleted $\delta^{13}C$ indicating hydrocarbon oxidation. Based on the $\delta^{18}O$ of these dolomites (-15.94 to -17.21‰ VPDB) and temperatures obtained from fluid inclusion (215ºC), the calculated $\delta^{18}O_{water}$ in equilibrium ($4 < \delta^{18}O_{Fluid} < 6.5‰$) indicates the involvement of sedimentary formation waters. Black dolomites formed at shallower depths.

Pyrites and native sulfur formed in a reducing environment where the source of sulfur was H_2S from evaporites. Heavy $\delta^{34}S$ for evaporites (ranging from 21 to 33‰) and sufides (ranging from 17.2 to 23.4‰) preclude sulfur contribution from magmatic sources or early Cambrian shale. The sulfate appears to be the likely source of high $\delta^{34}S$ with H_2S produced by the thermochemical reduction. Pyrites and dolomites formed at depth within the migration plume, hence, it is envisaged that hydrocarbon leaked along the flanks of the dome creating a reducing environment promoting the formation of diagenetic minerals.